

I Mountains Result from Collisions

Topic 1 Active and Passive Continental Margins

The continental margin is the boundary between continental crust and oceanic crust. This boundary occurs at the continental slope (see Chapter 18), not the shoreline. There are two basic types of continental margins—active and passive. Both are important to the formation of mountains.

Active continental margins occur along plate boundaries. Earthquakes, volcanoes, and mountain building result as the plates move relative to each other. An excellent example of an active continental margin is the west coast of South America. Here the dense, relatively thin, oceanic Nazca Plate is subducting under a less dense, relatively thin, continental South American Plate, forming the Andes Mountains.

Passive continental margins do not occur at plate boundaries. These margins are stable areas of shallow water where the major activity is the buildup of sediment. Some of the sediment comes from rivers flowing off the continents. Other sediment comes from skeletons and shells of marine organisms. An example of a passive continental margin is the Atlantic coast of North America. A wedge of sediment 250 kilometers wide and as much as 10 kilometers thick has accumulated there.

How are passive continental margins related to mountain building? The answer is that these margins are the only places where sediments accumulate in a quantity great enough to make a mountain. The mountains of today were passive continental margins in the past. The active continental margin on the west coast of South America was a passive continental margin until about 200 million years ago. The Andes Mountains contain the sediments that were deposited on that passive margin.

Topic 2 Collisions between Oceans and Continents

The Andes Mountains are an example of one type of mountain-building process—the collision of oceanic crustal material with continental crustal material. In this type of collision, oceanic crust plunges, or subducts, under the continent as rock layers on the

OBJECTIVES

- A** Describe active and passive continental margins and give examples of each.
- B** Discuss two ways in which mountains are formed during the collision between an ocean and a continent and give examples of each.
- C** Describe what happens when two continents collide and name places where such collisions are occurring.

continent form mountains. Subduction continues throughout the mountain-building process. Earthquakes are common. Friction from subduction generates magma, some of which rises to the surface to form volcanoes.

In some ocean-continent collisions of the past, another process appears to have accompanied subduction. In these cases, pieces of oceanic plate have ridden over the subduction zone rather than plunge into it. These pieces are found attached to the continents. This type of continental collision is thought to have been important to the formation of the west coast of North America. Like the west coast of South America, this area was a passive plate margin until about 200 million years ago. At that time, the Pacific Plate began to subduct under the North American continent. As it subducted, pieces of the Pacific Plate were scraped off and attached to the edge of the continent. Some of the pieces contained oceanic crust, some were islands, and some were fragments of other continents. These pieces became the mountains of the west coast of North America. They are *terrane*s, discussed in Chapter 13.

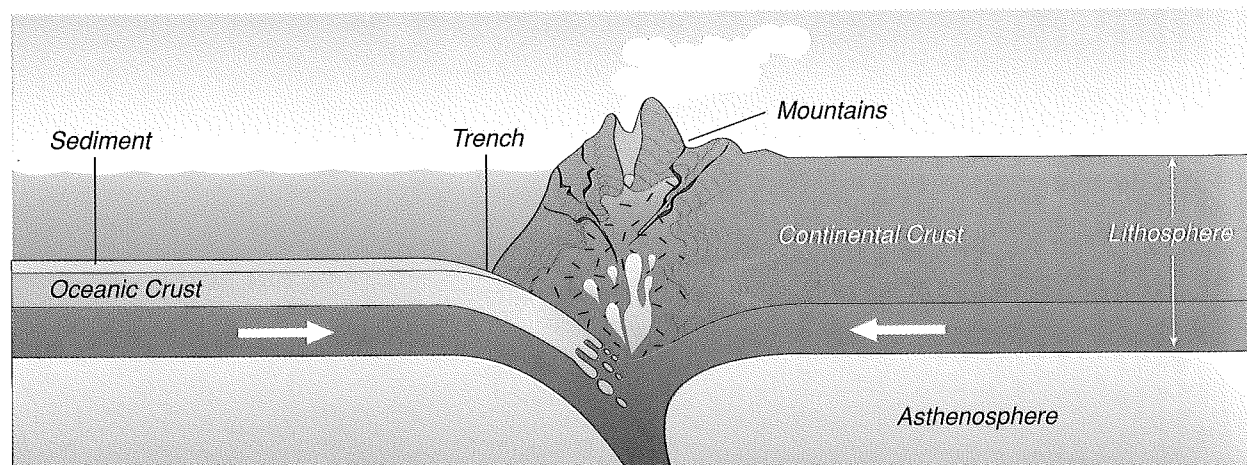
Topic 3 Collisions between Two Continents

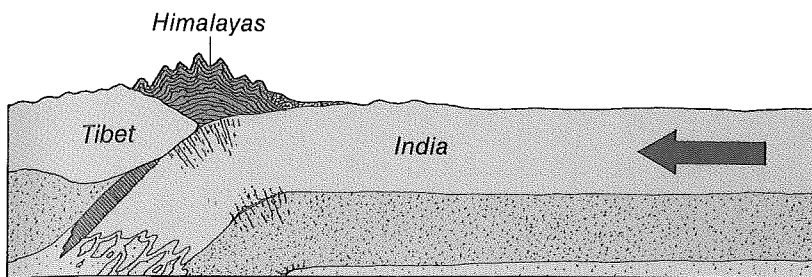
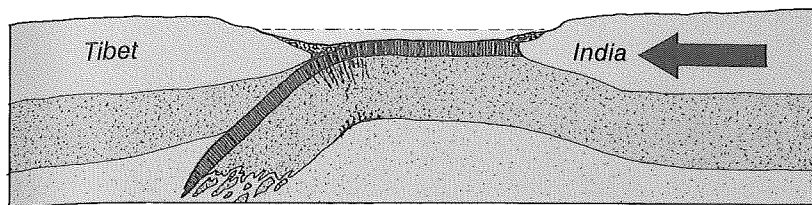
A second type of mountain building results when two continents come together at a collision boundary (Chapter 13, Topic 10). The collision of India with Eurasia to form the Himalaya Mountains is an example.

Before two continents can collide, the ocean basin between them must close. This change occurs as the oceanic crust subducts beneath one of the continents. Subduction stops, however, once the ocean is gone and the continents are in contact, because continental crust is too light to subduct. Continued movement causes the rocks of the continental margins to be crumpled into mountains.

The formation of the Himalaya Mountains was preceded by the closing of an ocean between India and Tibet, a part of Eurasia. The oceanic crust is thought to have disappeared into a subduction zone that plunged to the north under Tibet. Once the continental crusts

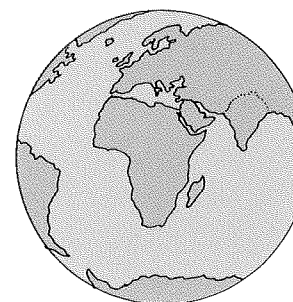
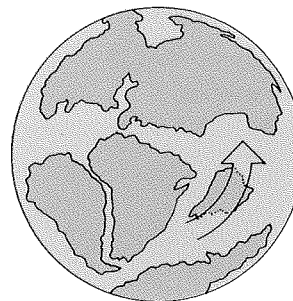
16.1 When an oceanic plate and a continental plate collide, the heavier oceanic plate subducts under the continental plate. Mountains form due to the related volcanism and compression.





collided, subduction stopped. However, India continued to move north, pushing some rocks aside and crumpling others into mountains. The severe earthquakes that occur in the Himalayas today indicate that the collision is still in progress.

Another example of a mountain range that is forming today by the collision of two continents is the Alps Mountains of Europe. Here the colliding landmass is Italy, which is actually a part of the African Plate. As the African Plate moves toward the Eurasian Plate, crossing the Mediterranean Sea, Italy is colliding with the Eurasian Plate.



16.2 When two continental plates collide, a portion of the crust at the collision boundary is crumpled into a mountain formation. The Himalayas formed in this way as the continental crust of the Indian Plate and the Eurasian Plate collided.

TOPIC QUESTIONS

Each topic question refers to the topic of the same number.

- (a) What kinds of earth processes occur at active continental margins? (b) Where is there an active continental margin today? (c) What is the major activity at passive continental margins? (d) Give an example of a passive continental margin. (e) How are passive continental margins related to mountain building?
- (a) What happens to oceanic crust in most ocean-continent collisions? (b) Where do mountains form in an ocean-continent collision? (c) What other processes accompany this kind of collision? (d) What has happened to oceanic crust in some ocean-continent collisions of the past? (e) Where are mountains thought to have formed by this kind of collision?
- (a) When does subduction occur during the collision of two continents? (b) Why does subduction stop? (c) Where was the subduction zone thought to be for India's collision with Eurasia? (d) What evidence indicates that the Indian-Eurasian collision is still in progress? (e) What other mountains, in addition to the Himalayas, are forming from the collision of two continents?